Today, Kerneos India is happy to announce the launch of SECAR GAZETTE. This is the very first issue. SECAR GAZETTE aims to provide the Indian refractory industry with relevant news and technical information so as to give you ready access to the latest knowledge about usage of calcium aluminates in refractory castables.

As a calcium aluminate cement pioneer since 1908, Kerneos has acquired outstanding expertise in aluminate technology and its various related applications, at the same time developing the practice of providing advice as well as technical and scientific support to its customers.

I sincerely hope you will enjoy reading the SECAR GAZETTE. We would be delighted to read your comments and opinions about the first issue.

Jean Christophe Trassard, Managing Director, Kerneos India

The control of placing and hardening properties of castables can be considered the key for successful castable lining installation. Differences exist among castable technologists, not only in the measurement techniques of placing and hardening properties of castables, but also in the definition of their basic terms. The article inside discusses this issue. (Full Paper on Page 3)

Dear Friends,
First of all, at the beginning of this New Year, let me wish you and your loved ones all the very best that life has to offer in 2012. No doubt, the year will offer new challenges to all of us involved in the Indian refractory industry.

The global unstable economic environment is expected to create some turbulence all over the world, including in India. The steel industry has been adversely affected by the iron ore crisis in Bellary as well as by the shortage of coal, particularly in the southern parts of India. Anyway, some recent signs indicate that the steel market may slowly pick up some steam. Mr Dalip Singh, Jt. Secretary Union Ministry of Steel, recently remarked that “the steel sector will not have any pressure for the next ten years due to the increasing domestic demand”.

The refractory manufacturers in India are gradually increasing their production level. So let’s hope for the best from our industry in 2012.

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Market Pulse

Operating Refractories – A treatise on Quality

The 56th Refractory Operating Committee Meeting was hosted by Rashtriya Ispat Nigam Limited on 28-29 December, 2011 at Ukkunagaram in Vishakhapatnam.

Mr. Umesh Chandra, Director (Operation), RINL was the anointed Chief Guest for the occasion. In his inaugural address, Mr. Chandra said that RINL achieved a specific refractory consumption of 9.8 kg/ton of crude steel as against 8-14 kg/ton in most of the Indian steel plants. Calling upon refractory technologists, researchers and industrialists to enhance refractory quality, he indicated that the production of superior grades was the need of the hour for improving performance.

Mr. A. P. Choudhury, CMD, RINL, conveyed his best wishes and hoped for fruitful deliberations and recommendations on the subject of refractory management during the course of the seminar.

The event garnered participation from RINL, SAIL, Tata Steel, JSW Steel, Meecon and RDCIS amongst others.

India emerging as a major Stainless Steel hub

Indian Stainless Steel Development Association has predicted that the annual stainless steel production in India will surpass 4 million tonnes by the end of 2012, a figure arrived at against the consumption of 2.6 to 2.7 million tonnes, which generates a surplus of 1.3 million tonnes.

Currently India’s per capita consumption of stainless steel is 1.2 kg, a substantially low figure when compared to the world average of 9.4 kg. India is expected to double its consumption in the next couple of years.

In India over 70% of the total stainless steel production is used by the kitchenware industry. However, this share will be ripe for revision by 2015-16 as consumption is expected to touch 2.0 million tons in this segment.

A huge area of demand has been created in the construction sector and consumption in this segment is expected to reach 0.5 million tonnes by 2015-16.

Indian Railways is planning to enhance stainless steel coach production adding to the existing 1,600 stainless steel coaches in its entire fleet of 60,000 coaches and 220,000 wagons.

The projection for 2010-15 suggests a 4.2% annual growth in worldwide demand for stainless steel, with growth reaching 7.7% for India and 6.2% for China in the same period.

Kerneos Corner

Kolkata gains a new Kerneos Applicative Laboratory

An Applicative Laboratory has been recently installed in Kolkata. This new facility aims at providing our refractory customers with a tailored technical support such as:

- Application optimisation studies,
- Resolution of specific technical issues,
- Specific analyses, on request,
- Technical development in partnership with customers.

This Laboratory is part of a global network of other Kerneos R&D centers all over the world, including the state-of-the-art KRTC (Kerneos Research and Technical Center) in Lyon, France and the expanding KDCC (Kerneos Development Center in China) in Tianjin, China.

The Kerneos Indian Laboratory will also focus on raw materials analysis & follow up and benchmark of competitive products; the objective being to develop a deep understanding of the local applicative conditions and sourcing constraints.

Kerneos’ industrial investment in India

Following the opening of its commercial subsidiary in Kolkata in March 2008, Kerneos will build its first plant in India. This plant will accompany the increasing demand of high performing products for refractory market to sustain the growth of the Indian steel industry. Magus Marketin Private Ltd., a well established player in the distribution of refractory materials in India, will be partner in this project.

A green field sintering unit of 30,000 tons/year capacity dedicated to the manufacture of calcium aluminate cements for the refractory applications is being built to produce a range of high quality products specifically designed for the Indian market needs.

This plant will be set up in the area of Visakhapatnam city (Vizag) in Andhra Pradesh. The efficient access to the refractory manufacturers, the vicinity of Vizag harbour and the support of the local authorities were some of the reasons for the selection of this location.

This Rs. 90 crore investment was initiated in collaboration with an Indian engineering company.

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Tech Edge

SECAR® 70V, a new calcium aluminate cement is officially launched by Kerneos during IREFCON 2012. SECAR® 70V, adapted for Indian climate is designed for conventional castables of India. These castable require versatility in terms of installation technique. Vibration-casting as well as patching require low working time, yet rapid hardening, so that the new lining can be workable within a short span of time. However, the rheology requirements of the two techniques are the opposite - the vibration-casting requires low water demand and high flow, where as patching does not require flow, rather needs good plasticity to stick to worn refractory lining. These diverse requirements of conventional castables are addressed by SECAR® 70V.

The Key Technical Benefits of the product include:

- Good working time and stable placing properties up to 45°C.
- Rheology compatible with classical installation methods of conventional castables, particularly vibration-casting and patching.
- Rapid strength development to aid demoulding or quicker return to service.
- Good mechanical performance and high temperature properties.
The placing (flow and flow decay) and hardening profile of castables, although often ignored by the castable users compared to the dried and fired properties in defining their product specification, result probably in the highest number of customer dissatisfaction. High temperature performance of a castable becomes ineffective unless appropriate placing, which comes at an early stage of castable usage is ensured. The final users of castable are also very keen to decrease down time of their furnace by improving efficiency of installation. Such improvement can be achieved by reducing the hardening time, although it is also important to keep the placing properties to the desired level. Therefore, castable manufacturers need to optimise the trade off between the placing and hardening properties, making their measurement vital to reach required performance of castables in a lining.

The evolution of rheology from mixing to the development of final structure can be followed by classical test methods, such as flow and strength development as a function of time. Non destructive test methods, such as measurement of exothermic profile and ultrasonic velocities can give continuous information from wet mixed paste to structured state. However, it is important, while using these test results for comparison with another set of results or for field applications, to consider the effect of temperature, equipment and the type of castable, formulation, raw materials, aging and thickness of a section, which influence these properties.

**Measurement of placing and hardening properties:**

**Flow profile:** Flow at different intervals after mixing are tested to obtain appropriate consistency required for optimum casting of refractory castables. Amount of water used in the castable mix has a strong impact on flow as well as hardening properties. Excess water may lead to segregation and lower strength, whereas inadequate water addition leads to poor consolidation during placement and incomplete cement hydration. Deflocculated castables are more sensitive to the water addition levels.

Both ASTM and EN standards use a flow cone with 100mm base diameter, 50mm height and 70mm top diameter (according to ASTM C230). The flow cone is filled with wet mixed castable and the cone is removed and subjected taps/vibration as per the standard (Table1). The final diameter of the castable “cake” is measured.
The flowability is calculated as: Flow\% = \left(\frac{\text{Cake diameter after taps/vibration} - \text{cone diameter}}{\text{X100/} \text{Cone diameter}}\right) (\text{Fig.1})

| IS 10570-1983 (Reaffirmed 2002) Ball in hand | EN 1402-4:2003, using a vibrating table, vibration for 30s with frequency of 50Hz and amplitude of 0.5mm for deflocculated and 0.75mm for conventional castables. | ASTM C1445-07, using a flow table as per ASTM C230, 15 drops in 9s from a height of 13mm |

| IS EN ASTM |

The flow values obtained with the ASTM method (taps) is significantly lower than those with EN method (vibration).

**Working Period:**

It is time after mixing up to which the castable retains just sufficient flow for casting. Generally, the castable after mixing is retained in a plastic pack. The castable is opened from this pack from time to time to check its flow.

**Working Time:**

The working time is the time at the end of the working period when the castable cannot be placed any more due to stiffening and loss of flow. It is time at the end of the working period when the castable starts to become hard. The castable is to consolidate. The top of the castable in the cup is pressed with a finger to check the time of hardening. This method is very subjective, although quite popular among Indian castable laboratories.

**Measurement of castable hardening kinetics:**

The hardening kinetics of castables can be followed by several techniques, such as exothermic profile, strength development and propagation of ultrasonic waves.

**Strength measurement:** Classical Compressive strength measurement after curing at 20°C with relative humidity >90% after 0-24h can give valuable information on progressive structure development. This method may be adapted to specific application conditions to generate hardening data, which may be related to demolding time.

**Non destructive techniques:**

a) **Exothermic profile:** This method is based on the principle that the heat of hydration of a calcium aluminate castable is released within a short span of time compared to those with the Portland cements. Therefore, the measurement of heat profile of a castable using a thermocouple is an easy technique to monitor hardening profile [1].

In this method, the castable after mixing is placed inside an insulated container. A thermocouple is inserted through the centre of the castable and is connected to a data recorder, which plots the temperature against time (Fig.2).

The peak temperature and the time to reach this peak temperature (PTT) are measured in this profile. This profile can be influenced by many factors, such as water %, type and addition level of admixture. Low cement castables generally develop two peaks, the first one is for the end of working time and the other of course for cement hydration.

b) **Ultrasonic measurement:** This technique is based on the principle that the propagation velocity of ultrasonic wave is faster in solids than in liquid or pastes. A sharp increase in the velocity can be correlated with the end of castable workability, which denotes the flocculation of castable and the formation of hydrate structure [2, 3].

Fig.3 shows a 8 channel ultrasonic apparatus, supplied by Ultrafast GmbH, Germany. In this method, a freshly wet mixed castable with 6mm maximum grain size is placed in a cylindrical mold and then vibrated for one minute to get rid of air bubbles, which hinder sound wave movement. Two piezoelectric transducers (transmitter and receiver) are placed at the both ends of the castable. Silicone grease is used to ensure good interface between the castable and the cells, as the shrinkage may cause disconnection of the castable and the mold. A compressive wave of 25kHz, generated by a transducer passes through the castable and is received by the other transducer at the opposite end at very short intervals (a few μs). A software converts the amplified signal to propagation speed (m/s).

References (full paper available at www.Secar.net):

